

PEPTIC ULCER—ITS ROENTGEN DIAGNOSIS*

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THE advent of the opaque meal in 1898 ushered in a new era in the diagnosis of gastro-intestinal diseases. While the energizing apparatus and tubes of that time did permit the visualization and study of gross deformities, such as the filling defects produced by large fungating carcinomata, they were not adequate for the accurate demonstration of smaller lesions.

DIAGNOSTIC AIDS

The most important immediate benefit of the opaque meal was that it permitted investigation of the normal "living" anatomy of the stomach and disclosed the wide variation in size, tonus, outline, and location more truthfully and convincingly than the autopsy table. It further allowed observation of the dynamics of digestion, peristalsis, motility, and tonus in a far more graphic and effective manner than any method theretofore attempted.

A few years later Reiche¹ was successful in demonstrating the cavity or crater of a gastric ulcer; and in the following year Haudek's classical description of the niche proved the feasibility of the direct diagnosis of peptic ulcer. The percentage of cases in which the niche could be directly visualized, particularly in duodenal lesions, was of course relatively small. The secondary signs of ulcer had been carefully noted—hyperperistalsis, hypermotility, local spasm, six-hour gastric residue, etc.—and the result was an overemphasis on these secondary signs and only a half-hearted attempt at direct visualization of the lesion.

On the Continent the tendency inclined toward emphasizing the fluoroscopic technique in the detection of gastric and duodenal lesions, while in this country the less expert use of the fluoroscope was somewhat compensated for by multiple roentgenographic studies. Cole, particularly, pioneered the use of serial films, and the serialograph attained quite general use in America. A period ensued during and after the World War in which relatively little advance in gastro-intestinal diagnosis occurred. Then Forssell,² Akerlund,³ and later Berg,⁴ made use of various compression devices as a means of obtaining more detailed information concerning localized lesions. As far back as 1911 Haudek used a wooden spoon to squeeze out all but a thin coating of barium from the suspected area during fluoroscopic examination. By the use of certain devices Forssell and Akerlund and Berg, working independently, were

successful in obtaining film studies with localized areas under compression.

Chaoul⁵ had experimented in 1915 with a compression cylinder designed to allow more complete filling of the duodenal bulb. Later he used a compression balloon to express barium contents during roentgen study. A modification of this device is today recognized as perhaps the simplest, most inexpensive and efficient of the various devices used for obtaining roentgenographic studies with compression.^{7, 8}

This work reached a high degree of perfection in Sweden and Germany before its value was appreciated in this country, due probably to the fact that it is a time-consuming procedure requiring considerable patience and experience. Even now this remarkably worthwhile refinement in gastro-intestinal diagnosis has been adopted by relatively few American roentgenologists.

Other factors which have contributed to the present degree of accuracy of roentgen diagnosis in general are improved transformers and tubes and the use of intensifying screens and speed films.

BASIS FOR GOOD ROENTGEN DIAGNOSIS

Regardless of the adequacy of equipment and the use of all the present-day refinements and supplementary procedures, it must be remembered that an accurate roentgen gastro-intestinal examination requires technical training, skill, and experience. The lack of any one of these requirements makes an examination not only of questionable value but may prove disastrous to the patient's welfare. Mistakes are unavoidable even among the most expert and experienced men, so the percentage of erroneous diagnoses in untrained hands can scarcely be estimated.

The only positive roentgen sign of peptic ulcer is the direct visualization of the ulcer niche. In gastric ulcer this is possible in a rather high percentage of cases (probably 90 per cent), but in duodenal ulcer, even with the most careful work and every advantage as to equipment and technique, the niche is visualized in only slightly more than 50 per cent of the cases. In a great many of the remaining cases, however, characteristic deformities and other signs, such as pyloric obstruction, warrant a definite diagnosis of ulcer. We believe that characteristic roentgen evidence of duodenal ulcer can be obtained in at least 95 per cent of patients having such lesions. Nevertheless a small group remains in which the roentgen findings are equivocal and it is in these cases that experience, clinical judgment, and an evaluation of indirect evidence, such as secondary roentgen signs, incidence of occurrence, etc., plays a tremendously important part.

Peptic ulcer may appear on any part of the gastro-intestinal mucosa that is bathed in gastric juice. Although they may occur at any point in the stomach or duodenum as far as the papilla of Vater, or even the cardiac end of the esophagus (regurgitation of gastric juice), they show a defi-

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nite predilection for certain sites. From the standpoint of x-ray diagnosis, they may be conveniently divided into four classes:

1. Esophageal peptic ulcer;
2. Gastric ulcer;
3. Duodenal ulcer;
4. Gastrojejunal ulcer.

ESOPHAGEAL ULCER

Peptic ulcers of the esophagus are rare as compared to gastric and duodenal ulcer. They are often erroneously diagnosed at postmortem, due to reflux of gastric contents into the lower esophagus with postmortem digestion of the mucosa. Practically all of them are confined to the lower two inches of the esophagus and usually they are situated on the right posterolateral wall. They may be from three millimeters to two centimeters in diameter and are often of the penetrating type. They are best demonstrated in the vertical or supine position, with the patient in the right oblique. A thick barium mixture is more effective in most cases. There is usually an accompanying cardiospasm.

GASTRIC ULCER

A great many erroneous diagnoses of gastric ulcer may be obviated by an understanding of the sites of predilection. The vast majority of benign gastric ulcers occur on the lesser curvature, usually in the lower two-thirds, and in the pyloric canal. In many instances they may be situated well toward the posterior wall. For this reason studies in the oblique as well as frontal planes are necessary. The greater curvature is so rarely attacked that the question immediately arises as to the benignancy of any ulcerative lesion occurring there. Various explanations have been offered. Perhaps the most plausible is that food on entering the stomach proceeds along the lesser curvature which thereby receives the maximum trauma from roughage. Moreover, the mucosal lining is more loosely attached in the lesser curvature than in other parts of the stomach. Cole emphasizes the relatively deficient blood supply of the lesser curvature.

Lesser curvature ulcers may be demonstrated with a marked degree of consistency by the use of the full barium meal. In most instances they are readily seen on fluoroscopic examination. The use of the fractional meal in such cases has not met with uniform success because of the inaccessibility of some lesions to palpation, and because a certain amount of hydrostatic pressure is required to force the barium into the niche.

Ulcers in the pyloric canal can rarely be visualized directly. Their diagnosis rests on the finding of persistent pylorospasm with attenuation of the pylorus. In the untreated cases, complete obstruction with dilatation of the stomach may occur.

Posterior-wall ulcers, particularly those situated toward the cardiac end of the stomach, may be very difficult to discover. They are often of the flat type and cause marked clinical manifestations, yet go undiscovered even under the most careful roentgen examination.

A disturbingly frequent occurrence is the case presenting classical symptoms of peptic ulcer in which no evidence of niche can be demonstrated. It is in this group particularly that recognition and evaluation of the secondary roentgen signs of ulcer are important. Among the most significant of these are incisura and pylorospasm, increased peristalsis and motility, and five-hour gastric retention.

Incisura, when present and persistent after antispasmodics, has a fairly definite significance. It is usually approximately opposite the point of ulceration, but it may be at some distance above or below the level of the lesion. Incisura may also occur with extragastric pathology, such as appendicitis, diverticulitis, and cholecystitis.

Disturbances of peristalsis and motility are frequently the result of nervousness and gastric psychoses, and their significance should be carefully evaluated from this standpoint. They are commonly increased in peptic ulcer, and peristalsis is interrupted at the site of the lesion.

The importance of five-hour gastric residue has steadily declined to such an extent that in some of the larger clinics the motor meal has been abandoned. More or less gastric retention is commonly found in the large ptotic stomach of the asthenic type, and its presence here is of questionable import. It is frequently encountered in women during menstruation. Of more significance is the paradoxical gastric residue associated with hypermotility. Carman's opinion that this finding is pathognomonic of peptic ulcer seems untrue, however, in the light of present-day knowledge.

Beyond any doubt the most difficult part of the diagnosis of gastric ulcer lies in the establishing or ruling out of malignancy. All arguments considered, there seems no doubt that ulcers become malignant. Whether some are malignant from the start is beside the point. The statistics of the Mayo Clinic would indicate that something over six per cent of all gastric ulcers will become malignant, that 68 per cent of all gastric ulcers with a crater two centimeters in diameter are malignant, that practically all gastric ulcers with a crater over three centimeters in diameter are malignant. Although these figures have frequently been challenged on the grounds that they are obtained by a primarily surgical group and that the "single cell" basis of microscopic diagnosis has not been generally accepted by pathologists, the figures do represent a thorough study of an exceedingly large number of cases, and as such merit careful consideration. Gastric analysis and a test of therapy are frequently necessary to decide the issue.

DUODENAL ULCER

The duodenal cap is the commonest site of ulceration in the gastro-intestinal tract. The appearance of lesions in this region presents a somewhat different picture from that seen in gastric lesions roentgenologically demonstrable. This is largely due to the thinner strata of wall structures. Direct roentgen evidence of duodenal ulcer is of two types: deformity of bulb contour and niche or crater visualization, with or without contour deformity. Fixed deformities may be caused by

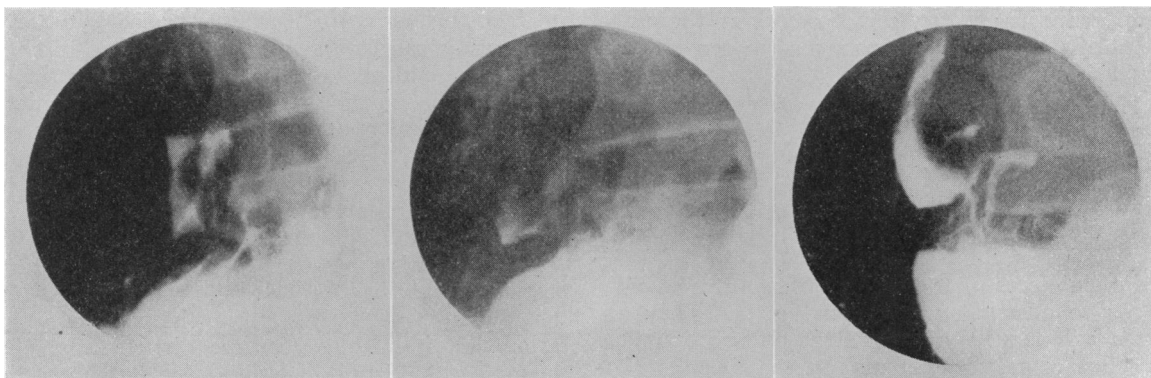


Fig. 1

Fig. 2

Fig. 3

Fig. 1.—Duodenal cap under compression showing ulcer niche with converging mucosal folds.

Fig. 2.—Same case after medical treatment, showing disappearance of niche.

Fig. 3.—Duodenal cap under compression, showing small ulcer niche. No contour deformity was visible in studies of the barium filled cap.

spasm or cicatricial changes and these occur in a variety of characteristic patterns. Niche evidence is roentgenologically shown as a spot of greater density due to deposition of barium particles in the crater of the ulcer. Niche sizes and patterns vary as greatly as do contour deformities. Previous to the extensive studies of Berg and Akerlund in the development of compression technique, the chief direct roentgen evidence of ulceration was based on deformities of bulb contour.

The value of compression technique lies in the fact that by its use the incidence of roentgenographic niche visualization is 30 to 40 per cent greater than that obtained by other procedures. Moreover, it permits an accurate estimate of the size and contour of a lesion and in some instances the extent of induration and the condition of the surrounding mucosa. Furthermore, two years of experience with this method have convinced us that the penetrating type of ulcer occurs in the duodenum more commonly than is generally believed. Obviously this statement cannot be supported by figures because in the great majority of cases medical treatment is indicated, only such cases coming to surgery as present other complications, such as recurrent severe hemorrhage, and those in which medical treatment is unsuccessful. Likewise, we have found that the apex of the duodenal cap is a much more frequent site of ulceration than is commonly thought (Figs. 5 and 6). The detail offered by compression studies is a valuable factor in the early discovery of such lesions, inasmuch as ulcers at this point do not commonly produce recognizable contour deformity in the barium-filled bulb.

The old roentgenologic dictum, "Once an ulcer, always an ulcer," has been thoroughly refuted by repeated observations of cases in which check-up studies after a period of medical treatment show partial or complete disappearance of the niche with cicatricial organization in the form of radiating mucous folds (Figs. 1, 2, 3, and 4). Comparative studies after medical treatment afford graphic evidence of the response of the lesion. On the other hand, if only contour studies of the barium-filled bulb are used, the character of the cap deformity may be exactly duplicated even though the ulcer

has healed. Some types of acute ulcer will show no spot of greater density or fleck retention consistent with niche evidence, but will show, according to Shindler⁶ and Forssell, an oval or round pseudo-polypoid defect, the diameter of which may be as small as one centimeter or as large as four centimeters. The general contour of the cap is usually abnormal in these acute cases, but is not necessarily of a fixed type. Forssell has explained this appearance as being due to cushions of inflamed mucous membrane around the ulcerating lesion. Niche evidence is difficult to obtain in such cases, but may be shown on repeated studies.

The use of the word "compression," in speaking of this supplementary roentgen procedure, may raise the objection of harmful results because of too great pressure over a diseased structure. The amount of pressure is not great; frequently the mildest degree suffices to distribute the barium solution in the bulb in the manner necessary to obtain mucosal relief patterns. Also the pressure is distributed over a palm-sized area and is not of point type.

GASTROJEJUNAL ULCER

The present-day accuracy of roentgen depiction of gastrojejunal ulcer is still far from satisfactory. The use of the fractional barium meal and multiple film studies, made with various degrees of pressure over the region of anastomosis, still fail to show a sufficiently high percentage of lesions to compare favorably with the accuracy of visualization of similar lesions in the stomach or cap.

While it is desirable to use the full barium meal to estimate emptying time, pyloric function, condition of the duodenal cap, and the presence or absence of retention pouches, most of the examination should be made with just enough opaque medium to coat the walls of the gastric pouch, the stomal orifice, and the jejunal loops in the immediate vicinity of the anastomosis. One swallow of a moderately thick barium and water paste is usually sufficient. Mild degrees of compression are used in obtaining the series of detailed studies. Niche visualization here, as in the stomach and cap, is evidenced by barium deposition in the ulcer

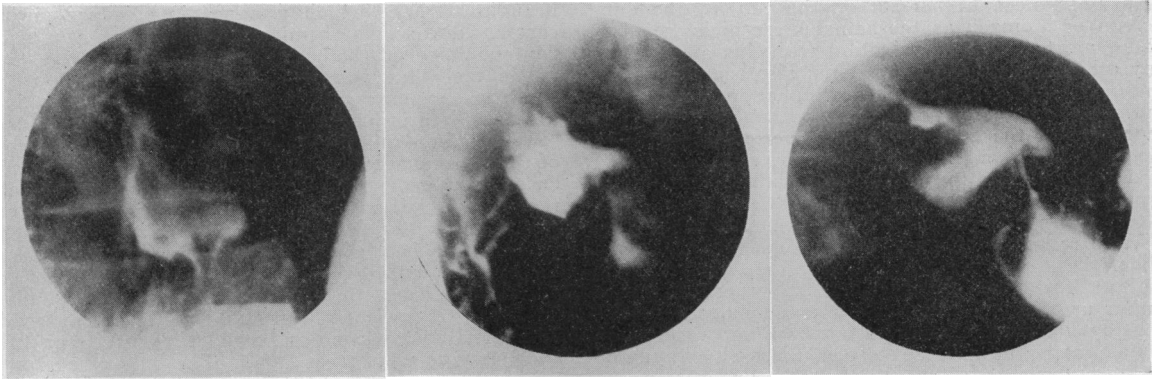


Fig. 4

Fig. 5

Fig. 6

Fig. 4.—Same case after medical treatment showing disappearance of niche.

Fig. 5.—Barium filled cap showing questionable contour deformity.

Fig. 6.—Same cap under compression showing definite ulcer niche in apex.

crater, which is commonly situated at the stomal border, more frequently on the duodenal aspect, or within two centimeters of the stomal orifice. Occasionally, however, lesions may be shown two to six inches from the stomach. In the absence of demonstrable niche evidence, close correlation of clinical symptoms and findings, and evidence of local tenderness noted on fluoroscopic observation are necessary to make a diagnosis of peptic gastrojejunal ulcer.

SUMMARY

The present-day status of roentgen visualization of peptic ulcer is discussed. Recent technical refinements, with the use of supplementary procedures for obtaining mucosal studies, permit the roentgenologist to attain a high degree of accuracy in the diagnosis of gastro-duodenal ulcer. This is particularly true in cases of duodenal ulcer in which the niche has been visualized through the aid of compression studies. Roentgenographic studies of such cases before and after medical treatment offer definite evidence of healing not obtained by other methods.

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DISCUSSION

KENNETH S. DAVIS, M.D. (2131 Ocean Avenue, Los Angeles).—Doctor Geyman's demonstration of "compression technique" for the direct visualization of duodenal ulcers is a distinct contribution to the gastro-

intestinal examination. In this work he has brought out one point which is of much interest to the radiologist: the possibility of having a penetrating duodenal ulcer without deformity of bulb contour except for the niche or fleck.

I have had several proved cases of duodenal ulcer in which the only roentgenographic finding was that of a niche on the lesser curvature of the cap or a fleck on the posterior wall, the latter only being demonstrable by direct anteroposterior palpation. In these patients the duodenal cap showed no incisura or other spastic deformities. In our routine gastro-intestinal examinations, I have found it of value to have the patient take one or two swallows of the barium mixture, following which I make a careful examination of the rugae on the posterior wall. In this manner I have been able to demonstrate flecks on the posterior wall which would have been overlooked by the use of a full barium meal.

I have also found that a careful study of peristalsis is a great help in localizing lesions in cases with indefinite roentgenographic evidence of ulcer.

In two cases of saddle-type gastric ulcer without niche formation, the only roentgenographic evidence of the lesion was an absence of peristalsis and a loss of the normal flexibility of the stomach wall in the area of involvement.

✱

R. G. TAYLOR, M. D. (1212 Shatto Street, Los Angeles).—The authors have given a very good presentation of what is known and practiced in the roentgen-ray diagnosis of peptic ulcer, and one naturally agrees with most of the statements made. The chief point made in the paper, of course, is the authors' description, experience, and conclusions with regard to the particular compression technique which they use for demonstrating the ulcer niche. We have had some experience with it, and while I think there is no question but what it is possible by its use to demonstrate and visualize an ulcer niche that would not be possible by ordinary methods, I am not at all sure that it raises the actual percentage of correct diagnoses of ulcers very much.

The authors say it is time-consuming and must be done in a painstaking and careful way in order to be at all successful or useful. This is surely true. Our own feeling about the method is that it is not needed in the majority of cases, and adds unnecessary time and expense to the examination.

Of the cases in which the secondary signs of ulcer are relied upon for a diagnosis, there is probably a small percentage in which these are not sufficiently definite to be relied upon. In this small percentage the use of the compression, with its attendant extra time and effort, is undoubtedly justified.

A point not stressed by the authors, but which has been demonstrated by our experience, is that there are sources of error of a very definite character connected with this type of examination. The recognition

of a small fleck of barium on the wall of the duodenum or stomach as the actual ulcer niche requires under most careful examination with this method (or any other) repeated observations; also the absence of the niche as the result of an examination of this type cannot be definitely determined without considerable repetition of the procedure. It is perfectly logical to expect that so small an ulcer crater, as is frequently present, cannot be invariably filled with barium. Ulcer craters as large as a centimeter, unless they are deep, often do not fill on the initial examination.

With regard to some of the secondary signs, I am under the impression from reading the paper that the authors feel that incisura and hyperperistalsis are rather usually and commonly found in ulcer. Roentgen-ray literature also gives one this impression. So far as gastric ulcer is concerned, unless it is situated at the pylorus we do not believe that hyperperistalsis is very frequent, and in our own experience incisura is rather uncommon.

With duodenal ulcer we agree with the authors that the apex of the duodenal cap is more frequently the site of the ulcer than is commonly thought from a perusal of the literature.

In the differential diagnosis between active ulcer of the duodenum and old deformity due to superficial scars and contraction, we believe that the elicitation of tenderness by direct palpation with the palpating finger is probably as useful a differential method as any.

We had hoped that this method would be of some help to us in demonstrating gastrojejunal ulcers, but it has been a disappointment. We are still relying on the secondary signs more than on the demonstration of the niche.

Also in high lesions under the costal margin, in obese or heavily muscled and sthenic habitus patients, the compression bag or cylinder is often of little or no help.

When all is said and done we must in the main agree with the authors that the use of the compression method does, without question, result, in a small percentage of cases, in the production of positive visualizable evidence of the actual lesion, and, this being so, roentgenologists should be equipped for and experienced in its use; but we still believe that the careful roentgenologist can find a niche nearly as often as it can be found by any method, during the fluoroscopic examination, by the use of manual compression with the gloved hand. However, if he wishes a permanent film record we commend the compression method described by the authors.

✱

HOWARD E. RUGGLES, M. D. (384 Post Street, San Francisco).—We have been using compression of the duodenum for about a year, and we find it of value in selected cases. Our feeling is that duodenal ulcer can usually be diagnosed by the older methods of careful fluoroscopy, palpation, and serial films. However, there is undoubtedly a small percentage of cases in which ulcer craters will be missed by following this routine, and it is worth while to at least observe the duodenum under compression whether or not films are made. Doctor Geyman is to be commended for again calling attention to this aid in diagnosis.

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DOCTOR GEYMAN, (Closing).—Doctor Davis mentioned niche evidence of duodenal ulcer demonstrable by anteroposterior palpation during fluoroscopic study. This is true of a considerable number of cases, but we feel that film studies made with local compression not only show the niche more accurately delineated but afford a permanent record which is very useful in evaluating the response of a lesion to treatment, as shown by future similar studies.

We have certainly not meant to give the impression that the supplementary use of compression technique in routine gastro-intestinal examinations will greatly increase the percentage of correct diagnoses of duodenal lesions, but there is without question an appreciable number of instances in which a small niche is

brought to light which was not in evidence during careful fluoroscopic examination and which caused no contour defect of the barium-filled bulb.

We feel that Doctor Taylor overemphasizes the additional expense involved; and the slight additional time required is justified by the information obtained.

We again wish to emphasize that the effectiveness of the procedure is directly proportional to the experience of the examiner with this method and we do not recommend it for occasional use. We do not agree with Doctor Taylor as regards accuracy of niche visualization by fluoroscopic examination. It is particularly difficult, even for a skilled fluoroscopist, to visualize mucosal detail when any degree of bulbar irritability is present. Film studies of such caps made with local compression and rapid exposure frequently show lesions with great detail. The only recent published figures on niche incidence where compression technique was not used are those of Doctor Kirklin, who found niche evidence in 15.24 per cent of duodenal ulcers seen at the Mayo Clinic in 1930. Our niche evidence is over 50 per cent. The use of compression technique does not replace any of the conventional procedures, but in our three years' experience with its use it has proved a valuable adjunct to the established methods.

THE MORPHOLOGY OF THE ERYTHROCYTES IN CIRRHOSIS AND OTHER DISORDERS OF THE LIVER*

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VERY little attention has been paid to the morphology of the red blood cells in cirrhosis and other disorders of the liver in which anemia is often a feature. Nothing unusual has been noted except in a few isolated instances, and it has been assumed that the erythrocytes have the same general characteristics as those ascribed to the other anemias occurring secondarily to organic disease. The anemia of cirrhosis has been classified with these as normocytic or microcytic and hypochromic, and it has not been emphasized that there are any distinguishing features.

Coincident with the present great interest in the treatment of anemias the importance of the size and shape of the red cells has become manifest. It is well recognized that in what has long been termed primary anemias the red corpuscles are characteristically very large and often oval, and that in certain types of so-called secondary anemias they appear to be very small and thick. While measuring the diameters of the erythrocytes in a large number of cases in the last three years, it has grown evident that the morphology of these cells in disorders of the liver is similar to that of primary anemia rather than secondary anemia, and that similar changes in number and size occur during appropriate liver therapy.

PREVIOUS INVESTIGATIONS

Although most investigations up to the present time have failed to separate in any way the anemia of hepatic disorders from the general picture of secondary anemias, there have been a few ob-

* This paper was submitted with the nom de plume "Arnold," and was awarded the California Medical Association Clinical Prize of \$150 at the sixty-second annual session of the California Medical Association, Del Monte, April 24-27, 1933.